UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION III

1650 Arch Street

Philadelphia, Pennsylvania 19103-2029

3/27/2002

Ms. Denise Ferguson Southard
Assistant Secretary
Maryland Department of the Environment
2500 Broening Highway
Baltimore, Maryland 21224

Re: Swan Creek

Total Maximum Daily Load (TMDL)

Dear Ms. Southard:

The U.S. Environmental Protection Agency (EPA), Region III, is pleased to approve the Swan Creek Total Maximum Daily Load (TMDL), submitted to the U.S. Environmental Protection Agency (USEPA) by the Maryland Department of Environment (MDE) by letter dated December 6, 2001 and received December 11, 2001, with complete data files received on January 22, 2002 and more information on January 24, 2002. The TMDL was established and submitted in accordance with Section 303(d)(1)(c) and (2) of the Clean Water Act. The TMDL was established to address impairment of water quality as identified in Maryland's 1996 Section 303(d) list. Maryland identifies the impairment for this water quality-limited waterbody based on low dissolved oxygen levels and nuisance levels of algae. Swan Creek is located in Harford County.

In accordance with Federal regulations found at 40 CFR § 130.7, a TMDL must: 1) be designed to meet water quality standards; 2) include, as appropriate, both wasteload allocations (WLAs) from point sources and load allocations from non-point sources; 3) consider the impacts of background pollutant contributions; 4) take critical stream conditions into account (the conditions when water quality is most likely to be violated); 5) consider seasonal variations; 6) include a margin of safety which accounts for any uncertainties in the relationship between pollutant loads and in-stream water quality; 7) include reasonable assurance that the TMDL can be met; and 8) be subject to public participation. The enclosure to this letter describes how the Swan Creek TMDL and supporting documentation satisfies each of these requirements. The supporting documentation provided with the TMDL report, specifically, the Technical Memorandum provides one allocation scenario with a zero wasteload for point sources and nonpoint source allocations. USEPA relied upon this information in reviewing and approving the TMDL submittal and in preparing USEPA's Decision Rationale. USEPA expects for future TMDLs that the Technical Memorandum will be included in any public notice of the TMDLs.

Following the approval of this TMDL, MDE shall incorporate it into the state's Water Quality Management Plan pursuant to 40 CFR § 130.7(d)(2). Also, any new or revised National Pollution Discharge Elimination System (NPDES) permits with applicable effluent limits must be consistent with the TMDL's WLA pursuant to 40 CFR § 122.44(d)(1)(vii)(B)(2). If an NPDES permit is issued with an effluent limitation that does not reflect the wasteload allocation contained in the approved TMDL and Technical Memorandum, it is expected that Maryland will document this change in the permit Fact Sheet, as discussed in USEPA's Decision Rationale.

If you have any questions or concerns, please call me or have your staff contact Mr. Thomas Henry, the TMDL Program Manager, at (215) 814-5752.

Sincerely,

/S/

Rebecca W. Hanmer, Director
Water Protection Division

Enclosure

cc: Mr. Jim George, MDE Mr.
Robin Grove, MDE

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Decision Rationale

Total Maximum Daily Load of Nitrogen and Phosphorus for Swan Creek Harford County, Maryland

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by the state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety, that may be discharged to a water quality-limited water body.

This document sets forth the United States Environmental Protection Agency's (USEPA) rationale for approving the TMDLs for nitrogen and phosphorus in the Swan Creek watershed. The TMDL was established to address impairments of water quality, caused by nutrients as identified in Maryland's 1996 Section 303(d) lists The Maryland Department of the Environment (MDE), submitted the *Total Maximum Daily Loads of Nitrogen and Phosphorus for Swan Creek, Hartford County, MD,* dated December 2001, to USEPA for final review on January 8, 2002. Follow-up information was received on January 22, 2002 and January 24, 2002. Swan Creek was first identified on Maryland's 1996 Section 303(d) list for nutrients and suspended sediments. Suspended sediments will be addressed separately by MDE in a separate TMDL document.

USEPA's rationale is based on the TMDL Report and information contained in the Appendix to the report. USEPA's review determined that the TMDLs meet the following eight regulatory requirements pursuant to 40 CFR Part 130.

1) The TMDLs are designed to implement applicable water quality standards.
2) The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.
3) The TMDLs consider the impacts of background pollutant contributions.
4) The TMDLs consider critical environmental conditions.
5) The TMDLs consider seasonal environmental variations.
6) The TMDLs include a margin of safety.
7) There is reasonable assurance that the TMDLs can be met.
8) The TMDLs have been subject to public participation.

The Technical Memorandum, *Significant Nutrient Point Sources in the Swan Creek Watershed* submitted by the Maryland Department of the Environment (MDE), specifically allocates nitrogen and phosphorus to Aberdeen Wastewater Treatment Plant (WWTP) (National Pollutant Discharge Elimination System (NPDES) permit number MD0021237) and Swan Harbour Dell WWTP (NPDES permit number MD0023043), the only significant point sources in the watershed. The Technical Memorandum, *Significant Nutrient Nonpoint Sources in the Swan Creek Watershed* submitted by MDE, specifically allocates nitrogen and phosphorus to

each of four separate land use/source categories (direct atmospheric deposition of nitrogen or phosphorus to the water surface is obviously not considered a "land use" source). Each land use or source is allocated some percentage of the total allowed nutrient load originating from nonpoint sources. Current nonpoint source load estimates were based on the Chesapeake Bay Model Phase IV Year 2000 loading coefficients that considers natural background, loads from septic tanks, as well as baseflow contributions. Likewise, the load allocations to each land use also consider natural background, septic tanks and baseflow. Each land use load allocation represents yearly allowable loads of nitrogen and phosphorus. In the low-flow scenario, specific nonpoint source allocations to different land uses could not be provided by MDE. Tables 1 and 2 summarize the gross allocations and TMDL.

Table 1- Phosphorus and Nitrogen TMDLs Summary for Low Flow, May 1 through October 31

Parameter	Rate	TMDL	WLA'	LA [2]	MOS[3]
Nitrogen	lbs/month	11,136	10,341	757	38
Phosphorus	lbs/month	759	727	30	2

[1] WLA = Waste Load Allocation
[2] LA = Load Allocation
[3] MOS = Margin of Safety

* The following is a clarification of Table 1. The wasteload allocations for low-flow are applicable from May 1 to October 31 in order to provide compliance with water quality standards during this critical period. Both WWTPs are currently running at 40% capacity. The WLAs represents the WWTPs running at design flow and at their approved NPDES maximum loading capacity. The LAs for low-flow represent flows developed using a' United States Geological Survey regression analysis and 1999 base-flow field data taken in Swan Creek.

Parameter	Rate	TMDL	WLA'	LA [2]	MOS[3]
Nitrogen	lbs/year	252,094	124,092	121,907	6,095

[1][2] WLA = Waste Load Allocation
LA Load Allocation

[3] MOS = Margin of Safety

* The following is a clarification of Table 2. The average-flow wasteload allocation values are also based on the achieving the same design flow and reduced loads year-round. Both WWTPs are currently running at 40% capacity. The WLA represents the WWTPs running at design flow and at their approved NPDES maximum loading capacity.

The TMDL is a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards. The TMDL is a scientifically-based strategy which considers current and foreseeable conditions, the best available data, and accounts for uncertainty with the inclusion of a "margin of safety" value. Conditions, available data, and understanding of the natural processes can change more than what was anticipated by the margin of safety. The option is always available to refine the TMDL for re-submittal to USEPA for approval.

II. Summary

Swan Creek' (Basin Segment 02-13-07-06), located in Harford County, generally flows in a southeastern direction approximately 4.5 miles to its confluence with the Chesapeake Bay, about 4 miles due south of the Susquehanna River. The dominant land uses in the watershed are forest/herbaceous (5,645 acres or 35%), mixed agriculture (5,483 acres or 34%), and urban (4,848 acres or 30%), with water (151 acres or 1%) comprising the remaining land use distribution.[2] Figure 1 shows the location of Swan Creek in Maryland.

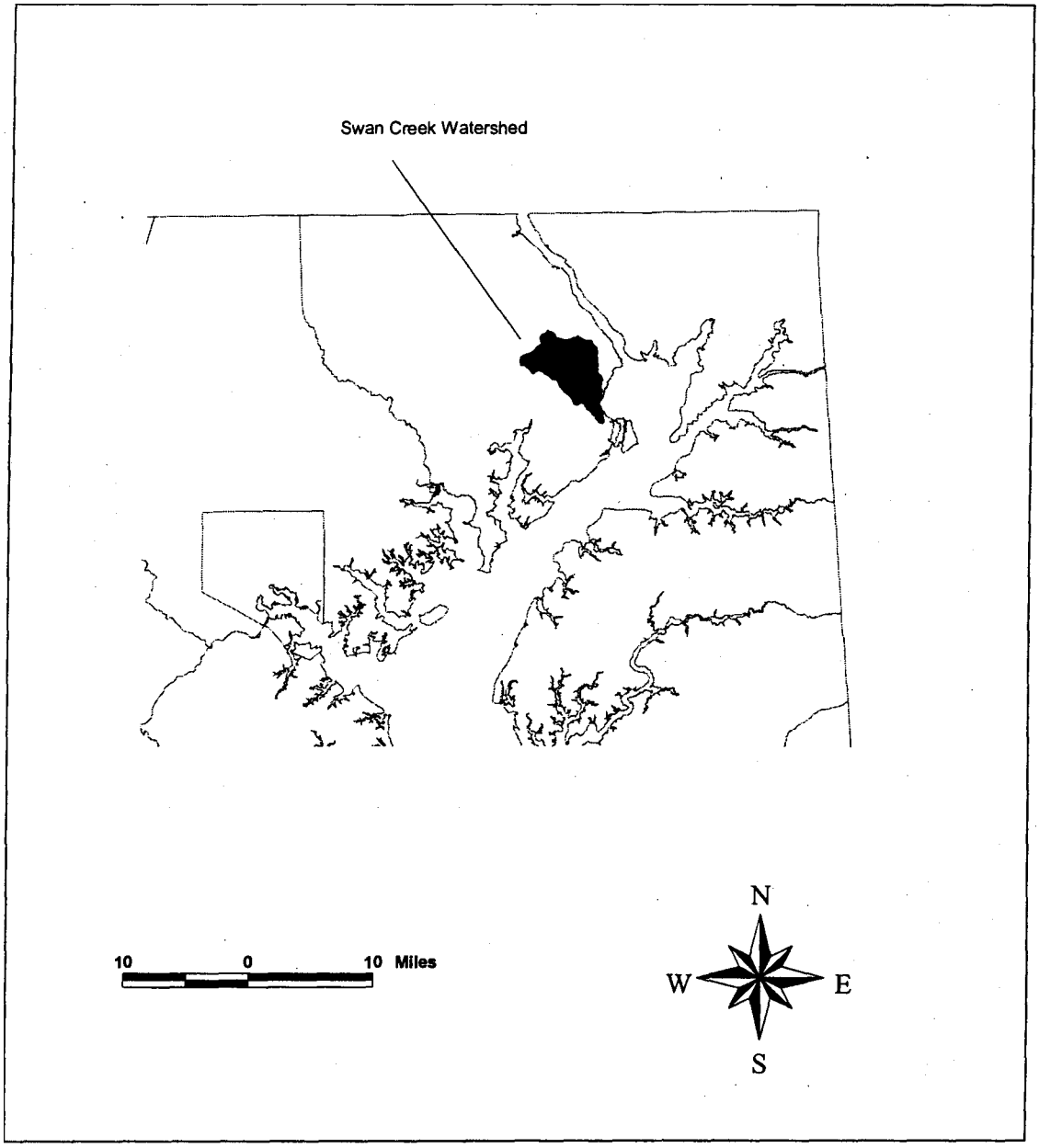

Figure 1 - Swan Creek Location

.' Swan Creek watershed is part of the Upper Western Shore Tributary Strategy Basin and comprises 16,127 acres.

[2] This information is based on 1997 MD Office of Planning and Farm Service Agency data.

In response to the requirements of Section 303(d) of the Clean Water Act (CWA), MDE listed Swan Creek on the 1996 Section 303(d) list of impaired waterbodies based on available information. The specific causes of impairment included signs of eutrophication in the form of high chlorophyll-a levels and suspended sediments. A eutrophic system typically contains an undesirable abundance of plant growth, particularly phytoplankton (photosynthetic microscopic organisms (algae)), periphyton (attached benthic algae), and macrophytes (large vascular rooted aquatic plants)'. These impairments interfere with the designated uses' of Swan Creek by limiting recreation, disrupting the aesthetics of the river, and causing harm to inhabited aquatic communities. MDE listed nutrients, both nitrogen and phosphorus, from natural and nonpoint sources as the causes and sources of the impairments, respectively. Swan Creek was given low priority on the 1996 Section 303(d) list. Section 303(d) of the CWA and its implementing regulations require a TMDL to be developed for those waterbodies identified as impaired by the State where technology-based and other controls did not provide for attainment of water quality standards. The TMDLs submitted by Maryland are designed to address acceptable levels of nitrogen and phosphorus, as demonstrated by the WASP 5.1 model, in order to ensure that water quality standards are maintained. These levels of nitrogen and phosphorus will provide for the control of eutrophication and seasonal algae blooms and ensure that the water quality criterion for dissolved oxygen is attained.

MDE developed these TMDLs to address the excessive nutrient enrichment that Swan Creek is currently experiencing. This TMDL is designed to satisfy the water quality standards and designated uses of Swan Creek only. Impairments in the remainder of the Upper Western Shore Tributary Basin watershed are not addressed by this TMDL. In addition, impairments due to suspended sediments are not addressed by these TMDLs.

In order to address the impairments of Swan Creek from the Section 303(d) list, MDE believes it is necessary to control excessive nutrient input to the system. Nitrogen and phosphorus are factors that exert influence on not only the concentrations of dissolved oxygen in a waterbody but also biomass (typically characterized as algae or phytoplankton and measured as chlorophyll-a for modeling purposes). Figure 2 illustrates the interrelationship of major kinetic processes for BOD, DO, and nutrient analysis.'

' Protocol for Developing Nutrient TMDLs. First Edition. November 1999. EPA 841-B-99-007.

[4] The designated uses of Swan Creek are Use I (Water Contact Recreation and Protection of Aquatic Life) and Use II (Shellfish Harvesting). See Code of Maryland Regulations 26.08.02.

' Technical guidance Manual for Developing Total Maximum Daily Loads, Book 2: Streams and Rivers, Part 1: Biochemical Oxygen Demand/Dissolved Oxygen and Nutrients/Eutrophication. Section 4.2.1.2. March 1997. EPA 823-B-97-002.

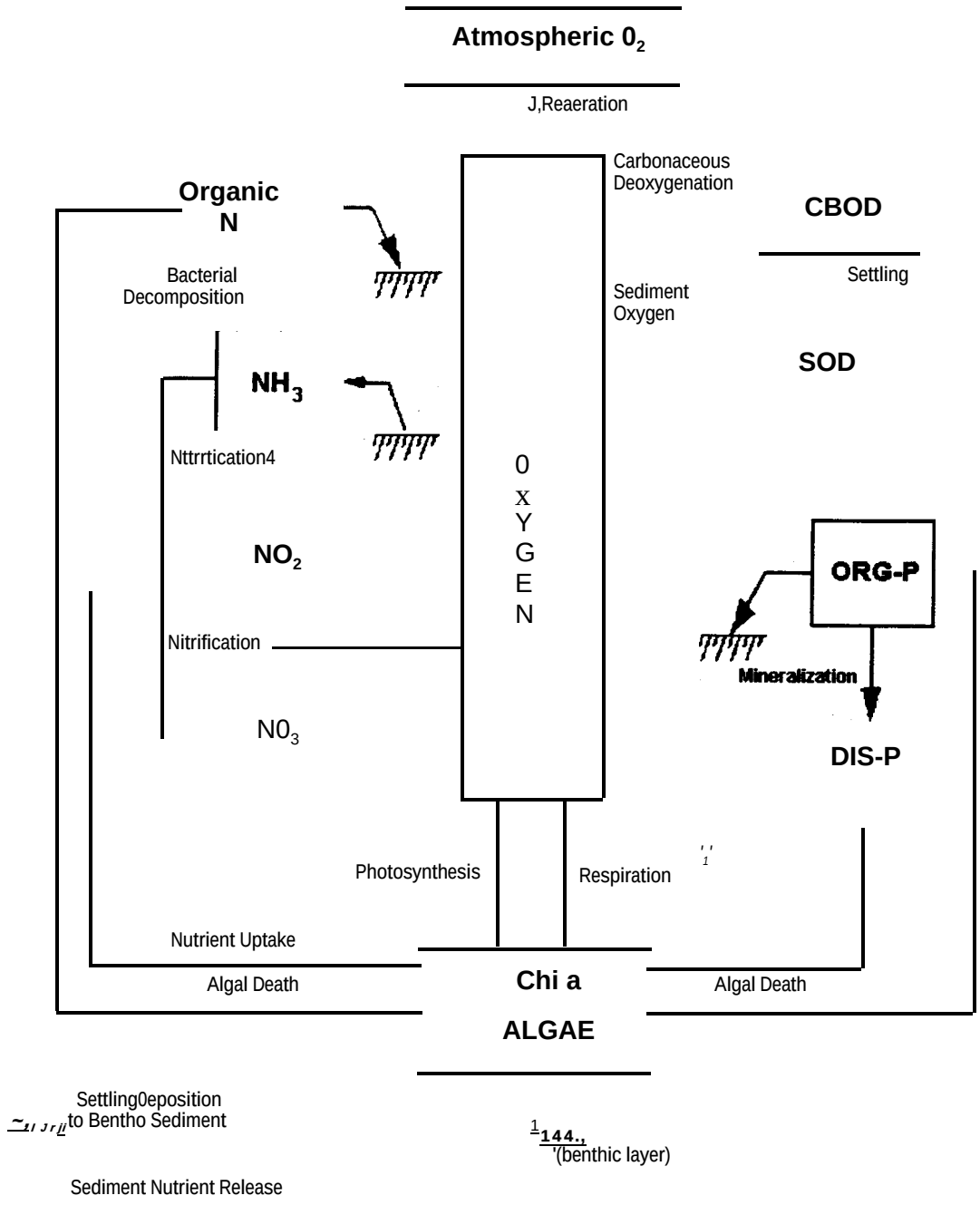

Figure 2 - Illustration of the interrelationship of major kinetic processes for BOD, DO, . -and nutrient analysis

Nutrient enrichment and subsequent algal growth are a concern in rivers and streams because of their effect on dissolved oxygen concentrations. Growing plants provide a net addition of dissolved oxygen to the stream on an average daily basis, yet respiration can cause low dissolved oxygen levels at night that can affect the survival of less tolerant fish species. Also, if environmental conditions cause a die-off of either microscopic or macroscopic plants, the decay of biomass can cause severe oxygen depressions. Therefore, excessive plant growth

can affect a streams ability to meet both average daily and instantaneous dissolved oxygen standards6. In addition, excessive nutrients lead to an overabundance of aquatic plant growth.

MDE uses WASP 5.1' to evaluate the link between nutrient loadings, algal growth, and dissolved oxygen. This evaluation is based on representing current conditions within Swan Creek system and determining the necessary reductions in nutrient loadings from various sources to achieve and maintain water quality standards: WASP 5.1 is a general-purpose modeling system for assessing the fate and transport of conventional and toxic pollutants in surface waterbodies (Ambrose, 1987)[8]. The model can be applied in one, two, or three dimensions and includes 2 sub-models (EUTRO5 and TOXI5) to investigate water quality/eutrophication and toxics impairments. EUTRO5 can simulate the transport and transformation of eight state variables including dissolved oxygen, carbonaceous biochemical oxygen demand, phytoplankton carbon and chlorophyll-a, ammonia, nitrate, organic nitrogen, organic phosphorus, and orthophosphate. WASP 5.1 has been previously applied in a number of regulatory and water quality management applications and is an appropriate linkage evaluation tool for Swan Creek. Based on this analysis, MDE has determined that the levels of nutrient input to Swan Creek specified by the TMDL will ensure that water quality standards are achieved by controlling algae blooms and maintained the dissolved oxygen water quality criterion.

III. Discussion of Regulatory Conditions

EPA finds that Maryland has provided sufficient information to meet all of the 8 basic requirements for establishing nitrogen and phosphorus TMDLs for Swan Creek. EPA therefore approves the TMDLs, Technical Memorandum, and supporting documentation for nitrogen and phosphorus in Swan Creek. Our approval is outlined according to the regulatory requirements listed below.

(1) The TMDL is designed to implement the applicable water quality standards.

MDE has indicated that high chlorophyll-a concentrations and the potential for low dissolved oxygen concentrations and algal blooms due to excessive nutrient input have caused violations of the water quality standards and designated uses applicable to Swan Creek. As previously mentioned, the designated uses of Swan Creek are Use I. The dissolved oxygen water quality criterion to support those uses indicates that DO concentrations may not be less than 5 mg/L at any time. While Maryland does not have numeric water quality criteria for nitrogen and phosphorus, Maryland interprets it's General Water Quality Criteria to provide numerical objectives for nitrogen and phosphorus which will support the dissolved oxygen water

[6] Technical guidance Manual for Developing Total Maximum Daily Loads, Book 2: Streams and Rivers, Part 1: Biochemical Oxygen Demand/Dissolved Oxygen and Nutrients/Eutrophication. Section 4.2.1.2. March 1997. EPA 823-B-097-002.

' Ambrose, R.B., T.A. Wool, and J.L. Martin. 1993. The water quality simulation program, WASP 5.1 version 5.10. Part A: Model documentation. U.S. EPA, ORD, ERL, Athens, GA.

' Compendium of Tools for Watershed Assessment and TMDL Development. May 1997. EPA 841-B-97-006.

quality criterion as well as a surrogate indicator (chlorophyll-a)[9]to determine acceptable algae levels in Swan Creek. Chlorophyll-a is desirable as an indicator because algae are either the direct (e.g. nuisance algal blooms) or indirect (e.g. high/low DO and pH and high turbidity) cause of most problems related to excessive nutrient enrichment[10]. The WASP 5.1 model used by Maryland will help to determine those nutrient levels and compliance with the DO criterion and chlorophyll-a levels.

The presence of aquatic plants in a waterbody can have a profound effect on the DO resources and the variability of the DO throughout a day or from day to day". This is due to the photosynthetic and respiration processes of aquatic plants that can cause large diurnal variations in DO that are harmful to fish. Photosynthesis is the process by which plants utilize solar energy to convert simple inorganic nutrients into more complex organic molecules[12]. Due to the need for solar energy, photosynthesis only occurs during daylight hours and is represented by the following simplified equation (proceeds from left to right):

$6CO_2$	$6H_20$	$C_6H_{12}0_6$	60_2
(Carbon Dioxide)	***(Water)***	***(Sugar)***	*(Oxygen)*

In this reaction, photosynthesis is the conversion of carbon dioxide and water into sugar and oxygen such that there is a net gain of DO in the waterbody. Conversely, respiration and decomposition operate the process in reverse and convert sugar and oxygen into carbon dioxide and water resulting in a net loss of DO in the waterbody. Respiration and decomposition occur at all times and are not dependent on solar energy. Waterbodies exhibiting typical diurnal variations of DO experience the daily maximum in mid-afternoon during which photosynthesis is the dominant mechanism and the daily minimum in the predawn hours during which respiration and decomposition have the greatest effect on DO and photosynthesis is not occurring. In order to ensure that the DO concentration of 5mg/1 is met at all times, MDE calculates both the daily average dissolved oxygen concentrations and the minimum diurnal DO concentrations as a result of photosynthesis and respiration of phytoplankton using the WASP 5.1 model.

In addition to the negative effects on DO, an overabundance of aquatic plant growth adversely impacts the aesthetic and recreational uses of a waterbody by decreasing water clarity and forming unsightly floating algae blooms which also hinder navigation. MDE utilizes chlorophyll-a, a surrogate indicator for algal biomass[13], to evaluate the link between nutrient loadings and aquatic plant levels necessary to support the designated uses of Swan Creek.

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[9] Chlorophyll-a is typically used as a measure of algal biomass in natural waters because most algae have chlorophyll as the primary pigment for carbon fixation (EPA 823-B-97-002).

[10] Supra, footnote 5.

" Principles of Surface Water Quality Modeling and Control. Robert V. Thomann., and J.A. Mueller. 1987. Page 283.

[12] Surface Water-Quality Modeling. Steven C. Chapra. 1997. Page 347.

[13] Biomass is defined as the amount, or weight, of a species, or group of biological organisms, within a specific volume or area of an ecosystem (EPA 823-B-97-002).

Again, using their General Water Quality Criteria, MDE establishes a numeric chlorophyll-a goal of 50 g/l. This level is based on the goals/strategies recommended by the Algal Bloom Expert Panel to prevent the occurrence of algal blooms similar to those experienced in the Potomac Estuary in 1983[14]. Specifically, the panel believed that nuisance conditions from algal blooms occurred when chlorophyll-a concentrations exceeded 100 g/L. Similar to the nutrientDO evaluation, MDE uses the WASP 5.1 model to determine acceptable levels of loadings of nutrients to achieve a chlorophyll-a concentration of 50 g/L.

EPA believes that the TMDLs for phosphorus and nitrogen will ensure that the designated uses and water quality criteria for Swan Creek are met and maintained.

2) The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.

Total Allowable Loads

The critical season for excessive algal growth in Swan Creek has been identified by Maryland as the months of July, August, and September. During these months, flow in the channel is reduced resulting in slower moving, warmer water that has less dilution potential and is susceptible to algal blooms and low DO concentrations. In order to control the algal activity and its impacts on water quality, particularly with respect to DO levels, Maryland has established individual TMDLs for nitrogen and phosphorus that are applicable from May 1 through October 31. Maryland presented these as monthly loads to be consistent with the monthly concentration limits that are required by NPDES permits. Expressing the TMDLs as monthly loads is consistent with federal regulations at 40 CFR 130.2(i), which state that TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure.

Maryland also recognized that nutrients might reach the river in significant amounts during higher flow periods. While available data does not indicate any problems with chlorophyll-a levels or low DO concentrations, Maryland performed the average annual flow analysis in order to characterize the impact of nonpoint source nutrient loadings. Although the water quality problems occur during low flow, the annual TMDLs are intended to prevent backsliding on current nonpoint source loads, thereby making an initial effort to address possible sedimentation problems when the situation is further evaluated.

The TMDLs for nitrogen and phosphorus are presented in Table 1 above.

EPA's regulations at 40 CFR 130.2(1), define "total maximum daily load (TMDL)" as the "sum of individual wasteload allocations for point sources and load allocations for nonpoint sources and natural background." As the total loads provided by Maryland equal the sum of the individual wasteload allocations for point sources and the land-based LAs for nonpoint sources set forth below and in the Technical Memoranda provided with the TMDLs, the TMDLs for nitrogen and phosphorus for Swan Creek are consistent with Section 130.2(1). Pursuant to 40

[14] Thomann, R.V., N.J. Jaworski, S.W. Nixon, H.W. Paerl, and J. Taft. March 14, 1985. Algal Bloom Expert Panel. The 1983 Algal Bloom in the Potomac Estuary. Prepared for the Potomac Strategy State/EPA Management Committee.

CFR 130.6 and 130.7(d)(2), these TMDLs and the Technical Memoranda and supporting documentation, should be incorporated into Maryland's current water quality management plan.

Wasteload Allocations

EPA regulations require that an approvable TMDL include individual wasteload allocations for each point source. Maryland's TMDL report for Swan Creek did not include individual waste load allocations for Aberdeen WWTP or Swan Harbour Dell WWTP of nitrogen and phosphorus. However, the Technical Memoranda did provide waste load allocation scenarios for both the low-flow and average-flow TMDLs, which are prsented in Tables 2 and 3.

Table 2 - Summaryy of low-flow WLAs for Nitrogen and Phosphorus

Facility	NPDES permit #	Parameter	Current permit Loading' (lbs/month)	**WLA** (lbs/month).	Reduction. needed (%)
Aberdeen WWTP[z]	MD0021237	Nitrogen	10,027	**10,027**	0
		Phosphorus	652	**652**	
Swan Harbour Dell W WTP[3]	MD0021571	Nitrogen	**314**	**314**	0
		Phosphorus	75	75	0

The current point source loadings assume maximum approved water and sewer plan **flow** and appropriate parameter concentrations expected to occur at that **flow.** For Aberdeen WWTP, the current loading was based on design **flow** of 4.0 mgd, a nitrogen concentration of 10 mg/L and a phosphorus concentration of 0.65 mg/L. For Swan Harbour Dell WWTP, the current loading was based on design **flow** of 0.05 mgd, a nitrogen concentration of 25 mg/L and a phosphorus concentration of 6.0 mg/L.

WLA same as current.

WLA same as current.

Table 3 - Summary of average-flow WLAs for Nitrogen and Phosphorus

Facility	NPDES permit #	Parameter	Current permit Loading' (lbs/year)	WLA (lbs/year)	Reduction needed (%o)
Aberdeen WWTP[2]	MD0021237	Nitrogen	120,324	120,324	0
		Phosphorus	7,820	7,820	0
Swan Harbour Dell W W TP[3]	MD0021571	Nitrogen	3,768	3,768	0
		Phosphorus	904	904	

The current point source loadings assume maximum approved water and sewer plan flow and appropriate parameter concentrations expected to occur at that flow. For Aberdeen W WTP, the current loading was based on design flow of 4.0 mgd, a nitrogen concentration of 10 mg/L and a phosphorus concentration of 0.65 mg/L. For Swan Harbour Dell WWTP, the current loading was based on design flow of 0.05 mgd, a nitrogen concentration of

2 25 mg/L and a phosphorus concentration of 6.0 mg/L. WLA same as current.

3 WLA same as current.

The point source loads used to represent the expected current conditions assumed maximum approved water and sewer plan flows. The wasteload allocations of the TMDLs represent point source loads which will provide compliance with the pertinent water quality standards. The low-flow monthly wasteload allocation values are most applicable from May 1 to October 31. No reductions were given to the point sources. Intermediate scenarios were provided by MDE (personal communication) to the USEPA showing that decreasing point sources does not have a significant effect on improving water quality in the watershed.

It is necessary to distinguish between current permitted loading, the wasteload allocation determined through the TMDL process, and actual loading. Current permitted loading refers to the allowable loading as designated by NPDES permit for each facility prior to the TMDL process. The wasteload allocation represents the allowable point source pollutant load necessary to achieve water quality standards as determined by the TMDL process. The actual loading represents the amount of pollutant loading that a facility is discharging. This load must not exceed the permitted load specified in the NPDES permit. However, it is very likely that actual loading is less than both the current permitted load and wasteload allocation such that pollutant loadings from particular facilities may not be impacted by the TMDL process. Conversely, permit limits may need to be adjusted to reflect the wasteload allocation determined in the TMDL process. Thus, while a facility may not be required to take action to reduce pollutant loadings, the NPDES permit may need to be revised in order to reflect findings from the TMDL process.

Load Allocations

Maryland provided adequate land use and loading data in the TMDL report, but did not distribute the total load allocation to specific land use categories in the TMDL report. Maryland included a gross load allocation for the low-flow and average-flow TMDLs. Those gross load allocations are contained in Table 1.

According to Federal regulations at 40 CFR 130.2(g), load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross. allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible natural and nonpoint source loads should be distinguished. MDE uses the Chesapeake Bay Program model Phase N loading coefficients (Year 2000 scenario), which are land use specific and include natural background contributions, atmospheric deposition (to land, not to water), and baseflow contributions.

As noted above, Maryland did not provide a breakdown of the load allocation in the TMDL report, however, such a breakdown was provided in the Technical Memorandum. The TMDL is based on nitrogen and phosphorus loading from the 4 land uses/sources within the watershed. The specific load allocations for the TMDLs during average flow are presented in Tables 4 and 5.

Table 4 - Summary of Load Allocations for Nitrogen (average flow)

Land Use Category	% Land Use	Watershed Area (acres)	% Nonpoint source current load	Nonpoint source current load (Ibs/yr)	% Nonpoint source TMDL load	Nonpoint source TMDL load (Ibs/yr)	reduction needed
Mixed Agriculture	34	5,483	52.1	105,845	52.1	63,514	40
Forest/other Herbaceous	35	5,645	**36.7**	74,559	36.7	44;740	40
Urban	30	4,848	5.7	11,580	5.7	6,949	40
Atmospheric Deposition'	1	151	5.5	11,174	5.5	6,705	40
Total	100	16,127	100	203,158	100	121,907	---

e a mosp e c epos t on oad is attributable to deposition only to surface water, atmospheric deposition to land surfaces is included in the loads attributed to mixed agriculture, forest and other herbaceous, and urban land uses.

Table 5 - Summary of Load Allocations for Phosphorus (average flow)

Land Use Category	% Land Use	Watershed Area (acres)	% Nonpoint source current load	Nonpoint source current load (lbs/yr)	% nonpoint source TMDL load	Nonpoint source TMDL load (lbs/yr)	reduction needed
Mixed Agriculture	21.4	23,819	38.4	6,255	38.4	3,753	40
Forest/other Herbaceous	54.6	60,792	58.7	9,562	58.7	5,737	40
Urban	21.1	23,464	0.6	98	0.6	59	40
Atmospheric Deposition'	2.9	3,260	2.3	375	2.3	225	40
Total	100	111,335	100	16,290	100	9,774	

The atmospheric deposition load is attributable to deposition only to surface water, atmospheric deposition to land surfaces is included in the loads attributed mixed agriculture, forest and other herbaceous, and urban land uses.

A breakdown by land use cannot be determined for nonpoint source loads during low flow. These nonpoint source loads, which were based on observed concentrations, account for "natural" and human-induced components. Table 6 presents the gross load allocations for low flow.

Table 6 - Summary of low-flow load allocations for Nitrogen and Phosphorus

Parameter	"Existing"' Nonpoint Source Load (lbs/month)	LA (lbs/month)	Reduction needed (%)
Nitrogen	1,255	757	40
Phosphorus	54	30	44

' Based on1999 observed field data. Reflects what is considered as current or baseline conditions.

Allocations Scenarios

EPA realizes that the above breakout of the total loads for nitrogen and phosphorus to the point sources and nonpoint sources is one allocation scenario. As implementation of the established TMDLs proceed, Maryland may find that other combinations of point and nonpoint source allocations are more feasible and/or cost effective. However, any subsequent changes in the TMDL must conform to gross waste load and load allocations and must ensure that the biological, chemical, and physical integrity of the waterbody is preserved.

Federal regulations at 40 CFR 122.44(d)(1)(vii)(B), require that, for an NPDES permit for an individual point source, the effluent limitations must be consistent with the assumptions and requirements of any available wasteload allocation for the discharge prepared by the state and

approved by EPA. EPA has authority to object to the issuance of an NPDES permit that is inconsistent with wasteload allocations established for that point source. To ensure consistency with these TMDLs, as NPDES permits are issued for the point sources that discharge the pollutants of concern to Swan Creek, any deviation from the wasteload allocations set forth in the Technical Memoranda and described herein for the particular point source must be documented in the permit Fact Sheet and made available for public review along with the proposed draft permit and the Notice of Tentative Decision. The documentation should; 1) demonstrate that the loading change is consistent with the goals of the TMDL and will implement the applicable water quality standards, 2) demonstrate that the changes embrace the assumptions and methodology of these TMDLs and Technical Memoranda, and 3) describe that portion of the total allowable loading determined in the state's approved TMDL report that remains for other point sources (and future growth where included in the original TMDL) not yet issued a permit under the TMDL. It is also expected that Maryland will provide this Fact Sheet, for review and comment, to each point source included in the TMDL analysis as well as any local and state agency with jurisdiction over land uses for which load allocation changes may be impacted.

In addition, EPA regulations and program guidance provides for effluent trading. Federal regulations at 40 CFR 130.2 (I) state: "If Best Management Practices (BMPs) or other nonpoint source pollution controls make more stringent load allocations practicable, then wasteload allocations may be made less stringent. Thus, the TMDL process provides for nonpoint source control tradeoffs." The State may trade between point sources and nonpoint sources identified in this TMDL as long as three general conditions are met; 1) the total allowable load to the waterbody is not exceeded, 2) the trading of loads from one source to another continues to properly implement the applicable water quality standards and embraces the assumptions and methodology of these TMDLs and Technical Memoranda, and 3) the trading results in enforceable controls for each source. Final control plans and loads should be identified in publicly available planning document, such as the state's water quality management plan (see 40 CFR 130.6 and 130.7(d)(2). These final plans must be consistent with the goals of the approved TMDLs.

Based on the foregoing, EPA has determined that the TMDLs and the Technical Memoranda for Nitrogen and Phosphorus for Swan Creek are consistent with the regulations and requirements of 40 CFR Section 130. Pursuant to 40 CFR 130.6 and 130.7(d)(2), these TMDLs and the supporting documentation, including the Technical Memoranda, should be incorporated into Maryland's current water quality management plan.

3) The TMDL considers the impacts of background pollutant contributions.

In terms of the low-flow TMDL analysis, Maryland used 1999 field data, collected during. August and September, which would adequately consider pollutant contributions from baseflow, which is considered to be most influential during low-flow periods, as well as other nonpoint source contribution such as atmospheric deposition and loads from septic tanks.

In terms of the high-flow TMDL analysis, Chesapeake Bay Model Phase IV loading coefficients (Year 2000 scenario) were used which effectively consider natural background, loads from septic tanks, as well as baseflow contributions.

4) The TMDLs consider critical environmental conditions.

EPA regulations at 40 CFR 130.7(c)(1) requires TMDLs to take. into account critical conditions for streamflow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of Swan Creek is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards. [15] Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition as critical because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

Based on the 1999 field data and current knowledge regarding eutrophication, Maryland identified the months of July, August, and September as the critical period. The specific conditions that describe this critical period are reduced flows in the stream (low-flow), higher concentrations of nutrients, and warmer water temperatures. These conditions combine to create favorable conditions for algal growth and wide fluctuations in DO concentrations that lead to violations of the designated uses and water quality criteria of Swan Creek. Furthermore, the data showed that chlorophyll-a levels were of concern and DO concentrations are violating the water quality criteria. The low-flow TMDL analysis using the WASP 5.1 model adequately considers those critical conditions.

The state also recognizes that increased nonpoint source loads of nutrients during precipitation events could adversely affect water quality, thus a critical condition itself. In fact, water quality modeling has shown the potential for algal blooms during this period as evidenced by chlorophyll-a levels above the target of 50 gIL. MDE has taken an environmentally conscious approach and developed an annual TMDL based on average flow conditions that are based on reductions of nonpoint sources of nitrogen and phosphorus from current loading levels.

5) The TMDLs consider seasonal environmental variations.

Seasonal variations involve changes in streamflow as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flow normally occurs during the colder period of winter and in early spring from snowmelt and spring rain, while seasonally low flow typically occurs during the warmer summer and early fall drought periods".

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[15] EPA Memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Water Management Division Directors, August 9, 1999.

[16] Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1, Section 2.3.3, (EPA 823-B-97-002, 1997).

Consistent with our discussion regarding critical conditions, the WASP 5.1 model and TMDL analysis will effectively consider seasonal environmental variations.

The TMDLs include a margin of safety

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. Margins of safety may be implicit, built into the modeling process, or explicit, taken as a percentage of the wasteload allocation, load allocation, or TMDL.

In terms of the low-flow TMDL analysis for both nitrogen and phosphorus, MDE explicitly allocates 5% of the load allocation value and reserves this for the MOS. For the high-flow TMDL analysis, MDE explicitly allocates 5% of the load allocation value and reserves this for the MOS.

In addition, MDE uses certain conservative assumptions that are implicitly included in the modeling process. The low-flow analysis sets a goal of 50 g/L for chlorophyll-a which MDE believes is conservative given the generally acceptable range of chlorophyll-a values for waters meeting their water quality standards of 50 - 100 g/L. The high-flow analysis was run under the assumption that Swan Creek would experience summer water temperatures and summer solar radiation. These conditions are unlikely given that high-flow analyses are typically done during winter and spring months of the year.

7) The TMDLs have been subject to public participation.

The TMDLs of nitrogen and phosphorus to Swan Creek were open for public comment from November 16, 2001 through December 17, 2001 Only one set of written comments were received by MDE, which was provided along with their response document with the TMDL report.

On October 4, 2001, EPA initiated informal consultation with the U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS) pursuant to Section 7(c) of the Endangered Species Act, regarding certain federal agency actions by EPA Region III regarding Maryland TMDLs. The Region forwarded a Biological Evaluation to the Services on February 8, 2002 regarding our proposed action on Maryland TMDLs. On February 27, 2002, EPA received concurrence from the U.S. Fish and Wildlife Services and on March 1, 2002 EPA received concurrence from the National Marine Fisheries Service that our action. is not likely to adversely affect endangered species and their critical habitat.

8) There is a reasonable assurance that the TMDL can be met.

EPA requires that there be a reasonable assurance that the TMDL can be implemented. wasteload allocations will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available wasteload allocation for the discharge prepared by the state and approved by EPA. Furthermore; EPA has authority to object to issuance of an NPDES permit that is inconsistent with wasteload allocations established for that point source.

Nonpoint source controls to achieve load allocations can be implemented through a number of existing programs, including Maryland's Lower Potomac Tributary Strategy, which was developed as part of Maryland's commitment under the Chesapeake bay Agreement. Other existing programs include EPA's Clean Water Action Plan and Maryland's Water Quality Improvement Act of 1998.

In addition, there will be follow-up monitoring within five years as part of Maryland's Watershed Cycling Strategy. This follow-up monitoring will allow Maryland and EPA to determine whether these TMDLs have been implemented successfully.